

AMENDMENT UNDER 37 CFR § 1.111
Application No. 09/903,476

contacting the oxygen treated catalyst with an aqueous medium selected from the group consisting of ammonium nitrate solution and ammonium carbonate solution.

19. A process for alkylating an aromatic compound comprising:

contacting an alkylatable aromatic compound and an alkylating agent with an alkylation catalyst comprising a molecular sieve under alkylation conditions; and

when said alkylation catalyst has become at least partially deactivated, contacting said alkylation catalyst with an oxygen-containing gas at a temperature of about 120 to about 600°C; and then

contacting the oxygen treated catalyst with an aqueous medium selected from the group consisting of ammonium nitrate solution and ammonium carbonate solution, wherein the molecular sieve of the alkylation catalyst is PSH-3, SSZ-25, MCM-36, MCM-49, MCM-56, faujasite, mordenite or zeolite beta.

Upon entry of the above amendment, claims 5 to 12 and 24 will have been reinstated, claims 5, 13, and 19 will have been amended, and claim 25 will have been added. Accordingly, claims 5 to 25 will remain pending in the application with claims 5, 13, and 19 being independent. Claims 1 to 4 were previously withdrawn from further consideration as being drawn to a non-elected invention.

Amendments to the Claims and Newly Added Claims

Claim 5 has been amended to clarify the purpose of the treatment steps described therein by adding the impact of each step on catalyst activity. Support for this amendment is found in the specification at page 13, Table and lines 6 through 10. Claim 5 has further been amended to clarify the last reference to the catalyst. Claims 6 through 12 have been reinstated without further amendment. Claims 13 and 19 have also been amended to clarify the last reference to the catalyst. Claim 19 has further been amended

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to remove the restriction that the aqueous medium be selected from an ammonium nitrate solution or an ammonium carbonate solution and to add MCM-22 to the listing of molecular sieves. Support for this amendment is found in the specification at page 8, lines 26 and 27. Support for the addition of MCM-22 is found in the specification at page 3, line 24.

Claim 25 has been added to cover an increase in mono-selectivity as described in the specification at page 9, lines 14 and 15 and at page 13, lines 6 through 10.

Applicants submit that the amendments to the claims, reinstated claims, and added claim do not introduce new matter, but rather place the claims in condition for allowance.

Response to the Prior Rejection of Claims 5 to 7 and 10 to 12 Under 35 U.S.C. § 102(b)

In the first Office Action, claims 5 to 7 and 10 to 12 were rejected under 35 U.S.C. § 102(b) as being anticipated by Chu et al. (U.S. Patent No. 4,886,616). The Examiner stated that Chu et al. (abstract; col. 10, line 56 through col. 11, line 25; the examples, namely example 4) disclose a process of alkylation of an aromatic hydrocarbon, such as toluene, with an olefin, such as ethylene, in the presence of a molecular sieve catalyst, which, after a period of use, is regenerated with air and an aqueous medium containing acetic acid. The Examiner stated that the timing, temperature, and calcination of claim 5 can also be found in example 4 of Chu et al.

Applicants respectfully disagree with the Examiner's position.

The claimed process differs from that of Chu et al. in several important respects. First, in the claimed process, treatment with the aqueous medium is used to restore catalyst activity, whereas Chu et al. describe treatment with the acetic acid for the specific purpose of restoring para-selectivity to a catalyst modified by the addition of certain metal and/or phosphorous oxides. No such modifications are required for the present invention, and no restoration of para-selectivity is required in the present invention. In fact, a preferred embodiment of the present invention is directed to increasing mono-selectivity, an opposite effect from that desired by Chu et al. Claim 5

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has been amended to recite the restoration of catalyst activity to clarify this difference between the inventions.

Second, in the claimed process, regeneration in an oxygen containing medium is a required step whereas Chu et al. only include an oxygen regeneration step in Example 4 as a negative comparative example. The purpose of contacting the alkylation catalyst of the present invention with an aqueous medium is to repair damage to the zeolite crystal resulting from the high temperature oxygen treatment step.

The Examiner has correctly noted that Example 4 does use conventional air regeneration followed by the treatment claimed by Chu et al., but it is respectfully noted that this inclusion was for the apparent purpose of stressing that such prior regeneration was not necessary, and in fact was not desirable. Applicants note that the two-step comparison of Chu et al. resulted in reduced toluene conversion as well as slightly lower para-selectivity as compared to the treatment claimed by Chu et al with no air regeneration step. (Table II). Chu et al. note that "it is not necessary to burn the accumulated coke deposits from the zeolite to realize the benefit of the present invention." (col. 14, lines 30 to 34) Applicants respectfully submit that Chu et al. teach away from using an oxygen regeneration step prior to their treatment, which is a treatment of different catalysts for a different purpose than the treatment of the present invention.

It is known in the art that para-selectivity of zeolites such as those preferred by Chu et al. can be enhanced by coating the surface with some material, including coke, to reduce the number of active surface sites and force the reactions to take place within the pore structure of the zeolite. The present invention is not limited to such shape selective considerations, and regeneration to restore activity to the surface sites is a desired result of the present invention. In fact, Table 1 on page 13 of the specification indicates that the present invention results in a reduction in para-selectivity for MCM-22.

It is further noted that the rejuvenation of Example 4 was carried out using acetic acid in air as opposed to an aqueous medium as described in the present invention.

Based on the differences described above, Applicants submit that Chu et al. do not anticipate the process defined by claims 5 to 7 and 10 to 12.

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With respect to the reinstated claim 24, Applicants submit that Chu et al. do not teach a process for alkylating an aromatic compound wherein the molecular sieve of the alkylation catalyst is selected from PSH-3, SSZ-25, MCM-22, MCM-36, MCM-49, MCM-56, faujasite, mordenite or zeolite beta.

For the foregoing reasons, Applicants request that the Examiner withdraw the rejection.

Response to the Rejection of Claim 8 Under 35 U.S.C. § 103(a)

In the first Office Action, dated August 6, 2002, claim 8 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Chu et al. (U.S. Patent No. 4,886,616). The Examiner stated that Chu et al. are silent about using benzene as an aromatic reactant, but the Examiner considers the use of benzene obvious since it would be expected that any aromatic can be alkylated in the presence of the catalyst described by Chu et al. Further, the Examiner contended that toluene is a homologue of benzene and since toluene can be alkylated in the process of Chu et al., one would expect that benzene, a closely related homologue, could also be alkylated.

Applicants respectfully disagree with the Examiner's conclusion. As noted above, the Chu et al. patent does not anticipate the invention recited in claims 5 to 7 and 10 to 12. Since claim 8 depends from claim 5, the claimed process would not have been obvious. Nowhere do Chu et al. show or suggest the particular recitations in claim 5.

For the foregoing reasons, Applicants request that the Examiner withdraw this rejection.

Response to the Rejection of Claim 9 Under 35 U.S.C. § 103(a)

In the Office Action, claim 9 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Chu et al. (U.S. Patent No. 4,886,616) alone or alternatively in view of Huss et al. (U.S. Patent No. 5,030,785).

Applicants submit that since Chu et al. do not disclose or suggest the process recited in claim 5, Chu et al. cannot suggest or disclose the process of dependent claim 9.

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The Examiner acknowledged that Chu et al. do not disclose that the sieve is MCM-22. The Examiner directed attention to Chu et al., the abstract, stating that the zeolite has a constraint index of 1 to 12. The Examiner relied upon Huss et al., table, at column 5, lines 13 and 14 showing that MCM-22 has a constraint index of 1.5.

Applicants respectfully submit that the Examiner's position is not well taken. In this regard, the Examiner has relied upon a selected portion of the abstract which speaks of a constraint index. The abstract also states that the zeolite which can be treated in accordance with the Chu et al. invention must have a silica to alumina ratio of at least 12 and have a minor proportion of the oxide form of one or more chemical elements (e.g. phosphorous and magnesium) deposited thereon. The Examiner, however, has not shown that MCM-22 has the other properties so that it can be used in the Chu et al. invention. In this regard, the Examiner's attention is directed to Chu et al., column 5, lines 42 to 45, which discloses the zeolites useful in the Chu et al. invention and to Chu et al., column 6, lines 19 to 42, which list zeolites which are not useful in his invention and zeolites which are useful in his invention. It is again noted that Table 1 on page 13 of the specification indicates that the present invention results in a reduction in para-selectivity for MCM-22.

For the foregoing reasons, Applicants request that the Examiner withdraw this rejection.

Applicants respectfully submit that the reasoning set forth above with respect to claims 5 through 12 applies equally to claims 13 through 25 as amended.

CONCLUSION


For the reasons advanced above, Applicants respectfully submit that all pending claims patentably define Applicants' invention. Allowance of the application is therefore respectfully requested.

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Should the Examiner have any further comments or questions, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,

Date 3/3/03



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APPENDIX

Marked up copy of claim 5

5. [Twice Amended] A process for alkylating an aromatic compound comprising: contacting an alkylatable aromatic compound and an alkylating agent with an alkylation catalyst comprising a molecular sieve under alkylation conditions; and
when said alkylation catalyst has become at least partially deactivated, at least partially restoring alkylation activity of said alkylation catalyst by contacting said alkylation catalyst with an oxygen-containing gas at a temperature of about 120 to about 600° C; and then
further increasing alkylation activity of said alkylation catalyst by contacting the oxygen treated alkylation catalyst with an aqueous medium.

Marked up copy of claim 13

13. [Twice Amended] A process for alkylating an aromatic compound comprising: contacting an alkylatable aromatic compound and an alkylating agent with an alkylation catalyst comprising a molecular sieve under alkylation conditions; and
when said alkylation catalyst has become at least partially deactivated, contacting said alkylation catalyst with an oxygen-containing gas at a temperature of about 120 to about 600° C; and then
contacting the oxygen treated alkylation catalyst with an aqueous medium selected from the group consisting of ammonium nitrate solution and ammonium carbonate solution.

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Marked up copy of claim 19

19. [Twice Amended] A process for alkylating an aromatic compound comprising:
contacting an alkylatable aromatic compound and an alkylating agent with an
alkylation catalyst comprising a molecular sieve under alkylation
conditions; and
when said alkylation catalyst has become at least partially deactivated, contacting
said alkylation catalyst with an oxygen-containing gas at a temperature of
about 120 to about 600° C; and then
contacting the oxygen treated alkylation catalyst with an aqueous medium
[~~selected from the group consisting of ammonium nitrate solution and~~
~~ammonium carbonate solution~~], wherein the molecular sieve of the
alkylation catalyst is PSH-3, SSZ-25, MCM-22, MCM-36, MCM-49,
MCM-56, faujasite, mordenite or zeolite beta.